

CLAIMS

We claim:

1 1. A magnetic head comprising:
2 a read-head portion that includes one or more read insulation layers;
3 a write-head portion that includes one or more write insulation layers; and
4 one or more insulation layers that are optional and, if present, are disposed between
5 the read-head portion and the write-head portion;
6 wherein at least one insulation layer selected from one of the read insulation layers,
7 one of the write insulation layers, or one of the optional insulation layers includes a material
8 having a negative thermal expansion characteristic.

1 2. The magnetic head of claim 1, wherein the negative thermal expansion
2 material is selected from carbon fiber, carbon fiber in an epoxy matrix, carbon fiber in a
3 photoresist matrix, zirconium tungstate ($\text{Zr W}_2 \text{O}_8$), zirconium tungstate in an epoxy matrix,
4 zirconium tungstate in a photoresist matrix, hafnium tungstate ($\text{Hf W}_2 \text{O}_8$), hafnium
5 tungstate in an epoxy matrix, or hafnium tungstate in a photoresist matrix.

1 3. The magnetic head of claim 1, wherein the insulation layer that includes the
2 negative thermal expansion material is selected from one or more of an undercoat insulation
3 layer disposed between the read-head portion and a substrate, a first insulation layer within
4 the read-head portion, a second insulation layer within the read-head portion, a write gap

5 layer within the write-head portion, a coil insulation layer within the write-head portion, or
6 an overcoat insulation layer.

1 4. The magnetic head of claim 1, wherein the write-head portion further
2 includes at least two layers of induction coil turns and at least one coil insulation layer
3 disposed between the induction coil layers.

1 5. The magnetic head of claim 1, further including a heat transfer layer.

1 6. A magnetic head comprising:
2 means for writing information to a magnetic medium, the writing means including
3 write-head electromagnetic components;
4 means for reading information from the magnetic medium, the reading means
5 including read-head electromagnetic components; and
6 means for insulating the electromagnetic components, where at least a portion of the
7 insulating means is also means for reducing the thermal expansion of the magnetic head.

1 7. The magnetic head of claim 6, wherein the writing means further includes at
2 least two layers of means for inducing a magnetic field, where the two layers are separated
3 by means for insulating the inducing means that is also means for reducing the thermal
4 expansion of the magnetic head.

1 8. The magnetic head of claim 6, further comprising:

2 an air bearing surface that includes a surface of the writing means and a surface of
3 the reading means; and
4 means for transferring heat away from the air bearing surface.

1 9. A disk drive for reading and writing information in a magnetic medium, the
2 disk drive comprising:

3 a disk having a surface that includes the magnetic medium;
4 a motor coupled to rotate the disk;
5 a slider having an air bearing surface;
6 an actuator configured to hold the air bearing surface of the slider proximate to the
7 surface of the disk;

8 a magnetic head disposed within the slider and forming part of the air bearing
9 surface, wherein the magnetic head includes:

10 i) a read-head portion that includes one or more read insulation layers;
11 ii) a write-head portion that includes one or more write insulation layers; and
12 iii) one or more insulation layers that are optional and, if present, are disposed
13 between the read-head portion and the write-head portion;
14 wherein at least one insulation layer selected from one of the read insulation layers,
15 one of the write insulation layers, or one of the optional insulation layers includes a material
16 having a negative thermal expansion characteristic.

1 10. The disk drive of claim 9, wherein the negative thermal expansion material is
2 selected from is selected from carbon fiber, carbon fiber in an epoxy matrix, carbon fiber in

3 a photoresist matrix, zirconium tungstate ($\text{Zr W}_2 \text{O}_8$), zirconium tungstate in an epoxy
4 matrix, zirconium tungstate in a photoresist matrix, hafnium tungstate ($\text{Hf W}_2 \text{O}_8$), hafnium
5 tungstate in an epoxy matrix, or hafnium tungstate in a photoresist matrix.

1 11. The disk drive of claim 9, wherein the insulation layer that includes the
2 negative thermal expansion material is selected from one or more of an undercoat insulation
3 layer disposed between the read-head portion and a substrate, a first insulation layer within
4 the read-head portion, a second insulation layer within the read-head portion, a write gap
5 layer within the write-head portion, a coil insulation layer within the write-head portion, or
6 an overcoat insulation layer.

1 12. The disk drive of claim 9, wherein the write-head portion further includes at
2 least two layers of induction coil turns and at least one coil insulation layer disposed
3 between the induction coil layers.

1 13. The disk drive of claim 9, wherein the magnetic head further includes a heat
2 transfer layer.

1 14. The disk drive of claim 13, wherein the slider is further configured to
2 dissipate heat and is thermally coupled to the heat transfer layer.

1 15. A disk drive for reading and writing information within a magnetic medium,
2 the disk drive comprising:

3 means for holding the information in a magnetic form;
4 means for rotating the holding means;
5 a slider having an air bearing surface; and
6 means for positioning the air bearing surface of the slider proximate to the holding
7 means;
8 wherein the slider further includes a magnetic head including:
9 i) means for writing the information into the holding means, the writing means
10 including write electromagnetic components;
11 ii) means for reading the information from the holding means, the reading
12 means including read electromagnetic components; and
13 ii) means for insulating the read electromagnetic components and the write
14 electromagnetic components, wherein at least a portion of the insulating means is
15 also means for reducing the thermal protrusion of the magnetic head into the air
16 bearing surface.

1 16. The disk drive of claim 15, wherein the writing means further includes at
2 least two layers of means for inducing a magnetic field, where the two layers are separated
3 by means for insulating the inducing means that is also means for reducing the thermal
4 protrusion.

1 17. The disk drive of claim 15, further comprising means for transferring heat
2 away from the air bearing surface.